

Minutes from the 1st ISWG Meeting -- January 24/25 2001 Boardroom, STScI

Compiled by M. Rieke, ISWG Chair

Present: M. Rieke, H. Hammel, S. Lilly, R. Kirshner, J. Hutchings, M. McCaughrean, E. van Dishoeck, G. Helou, M. Werner, M. Stiavelli, P. Stockman, P. Jakobsen, J. Mather, R. Kudritzki, R. Kennicutt, B. Fosbury

The members of the ISWG were introduced to John Mather, the NGST Project Scientist, Bernie Seery, the NGST Project Manager, and other Project Personnel. The ISWG also heard statements about the importance of NGST to the Space Telescope Science Institute by Mike Hauser. Anne Kinney told the ISWG what she expected of us, namely to represent the science community to the NST Project, and to give advice on the scientific choices that the Project would be facing.

After introductions, Bernie Seery explained the competitive nature of the NGST facility procurement and ISWG members signed non-disclosure agreements with the two companies being funded to carry out NGST studies, TRW-Ball and Lockheed. The ISWG would then be allowed to hear presentations on the various concepts for NGST.

John Mather gave an overview of the development of the science program and how the ASWG (Ad-Hoc Science Working Group) had created the design reference mission. He concluded with a list of questions that the Project would like answered by the ISWG. These questions are listed in Attachment 2.

Bernie Seery presented the re-scope of NGST from having an 8-meter primary to having a smaller primary (contractors had to leave).

A number of items arose:

- early chart implies that raising OTA temperature is to solve sunshield issues?
- Werner asked whether the trade space of available sky versus sunshade characteristics was explored and the answer was that it had been but perhaps not fully
- Mirror smoothness has only been imposed via an encircled energy criterion, and it was stated that this is not significant driver unless one wants a diffraction limit at ~ 0.6 m
- Rolf pointed out that Telescope Scaling Law (diameter versus cost) plot does not match formula
- John Hutchings pointed out that knowledge of how rapidly mirror performance degrades towards shorter wavelength is needed
- need for heating arises in part from the fact that NGST cannot be an athermal design, 50K chosen to increase the amount of heat that the OTA can radiate to space to permit a stable equilibrium
- Peter J pointed out that in letting the OTA go up to 50 K, there must be at least a second order effect that the ISIM and its mid-infrared section may have to handle a higher heat load
- Bernie stated that a new launch fairing would cost \$150M and was not under consideration
- Cost estimate is \$650M (FY96) not including foreign contributions and not including launch

The agenda order was changed and the CSA Report was given by Simon Lilly and John Hutchings. They were very unhappy about the manner in which they had been informed of the NGST re-scope. They did not learn about it directly from the Project but rather, they read about it in the news. They requested that they be kept better informed. The Canadians are still coming up to speed on the de-scope and have not yet had a steering committee meeting since the re-scope was announced.

They next described the current thinking about the instrument contribution Canadians would make. Under consideration is having CSA participating in NIRCAM on a 50-50 basis with NASA. The mid-IR agreement between ESA and NASA drafted by the Mid-Infrared Planning Group was being used as a model. They stated that they need to know what the answer to this proposal is this quickly as CSA had already funded one instrument study only to have to stop as that instrument was not deemed sufficiently close to the core capabilities to be acceptable. Rieke was asked what she thought the reaction in the U.S. community would be, and she replied that it would be very negative, not because of any lack of confidence

in the abilities of the Canadians but rather because the U.S. community would want to build at one of the three instruments themselves. Other committee members expressed similar sentiments that since the U.S. is the major partner in the project, they should oversee construction of an instrument in its entirety. The Canadians further explained that their desire was to participate as intellectual partners, not just as parts suppliers.

Peter Jakobsen reported on behalf of ESA who also do not have an official reaction to the re-scoping and are still briefing advisory committees. NGST is now an officially approved ESA project and on the Web there is an ESA report on the participation in NGST. He also showed the official agreement between ESA and NASA which includes having ESA take the lead in construction of the NIR Spectrometer and sharing in the construction (using ESA member state National contributions) of the MIR instrument with NASA.

At this point, the ISWG discussed the draft charge for reviewing the re-scoped NGST. The resulting draft charge is listed in Attachment 6. The ISWG also discussed whether NGST should adopt a small number (say 4-5) of defining science themes against which the inclusion of scientific capabilities could be judged. A similar scheme was adopted for the re-scoping of SIRTf. No consensus was reached on this idea.

Matt Greenhouse reported on impacts of the re-scoping exercise to the Integrated Science Instrument Module (ISIM) and to the instruments themselves.

The instrument changes he presented are

NIR Cam

16 sq arc minute FOV, 0.6-5 m, Nyquist-sampled at 2 m = 64Mpixels **E goes to 48M**

NIR Spec (no change)

9 sq arc minutes FOV, 1-5 m, > 100 simultaneous spectra R~1000, long slit spectra at R~100, and acquisition imaging mode

MIR Instrument

1 sq arc minute FOV, 5-27 m, Nyquist sampled at 10 m, R~1500 long slit spectroscopy and broad-band imagery

E Goes to 1Mpixel cryogenically-cooled Si:As, 5 yr lifetime

He reminded us of the shared sub-system concept:

Shared subsystems

Common C&DH system, flight software and electronics,

Instrument mounting and interface structure

Passive and active cooling systems

GSE associated with above

He mentioned that several re-baseline performance options were considered:

Eliminate 1 of 4 NIRCAM modules -- **Adopted**

Eliminate 2 of 4 "

Adopt non-MEMS approach to NIRSpec

Eliminate MIR instrument

Several re-baseline cost plan options were considered:

No US contribution to MIR instrument

Prime contractor responsible for ISIM structure

NIRCam implemented as NASA facility instrument rather than PI instrument

Eliminate ISIM I&T

Shorten ISIM I&T -- **Adopted**

Adopt separate fine guidance sensor system (deferred to Phase 2)

Adopt cryostat rather than cryo-cooler approach for MIR instrument -- **Adopted**

(phasing)

Advance NIR detector selection by 1 year

The ISWG went into executive session at the end of the afternoon. A major topic of discussion was the progress (or lack of) on identifying a Canadian instrument contribution that would be satisfactory to all concerned. The U.S. members stated that they had confidence in the Canadians' ability to deliver whatever was agreed upon, but were unhappy with the proposed split of the NIRCам. The committee was not pleased that U.S., the major partner in NGST, would not have the opportunity to supply at least one instrument completely. Concern was also expressed over the complexity of the interfaces if the U.S. and Canada participated as equal partners both with stakes in the design. The Canadians expressed much unhappiness at how they had been treated in the negotiations for instrument shares. They had started on the study of one of the optional highly desirable instrument capabilities recommended by the ISWG (an integral field spectrometer at $R \sim 3000$). This study was stopped by the project as the result of a telecon between the Project Scientists representing all the partners because it was not deemed to represent high enough scientific value as compared to the cost (but no one could remember this telecon very clearly). The Canadians stated that they needed to identify their contribution very soon -- they had already started a study of how Canadian industries would be best able to contribute to the NIRCам. They were worried that CSA might become very unhappy if the Canadian plans had to change so radically very many more times.

The ISWG also identified a number of issues where they would like more information. These are listed in Attachment 5.

The re-scope was discussed in general - it was noted that point source sensitivity goes as D^{-4} , survey time goes as D^{-2} , resolved sources goes as D^{-2} and D^0 . Nothing about the re-scope indicated a complete loss of any of the science programs outlined in the DRM, but no one was happy with cutting the size of the primary mirror now. The science review to be executed by the ISWG in March will address these issues more fully.

End of the First Day

Thursday

Larry Petro presented estimates of the performance of the rescope NGST. This presentation is available as ISWG_Petro.pdf. One clear trend which emerged from this presentation is that the performance of NGST as compared to other facilities erodes relatively less at longer wavelengths as the size of the primary is reduced because the other space missions have such small mirrors (85cm in the case of SIRTf) and because the background is so high on the ground. Additionally, the mid-infrared detector performance relative to the zodiacal background is better than for shorter wavelength detectors so NGST will remain background limited at $R \sim 1000$ even with a smaller primary at the longer wavelengths.

Peter Stockman presented a study of science policies that needed to be included in the instrument Announcement of Opportunity. He suggested a level of Guaranteed Time for instrument teams at a level similar to the current Great Observatories (e.g. HST, SIRTf): a team should receive approximately 10% of one year's observing time spread over the first few years of the mission. The ISWG concurred with this level. There was also discussion of what other members of the flight Science Working Group should be solicited in the AO. The ISWG recommended that a Telescope Scientist, a Facility Scientist, and two interdisciplinary scientists be sought now with the possibility of adding more later.

Matt Greenhouse gave more details on what might appear in the instrument AO:

- \$25M FY96 Contribution to NIRCам by CSA

- Need agreement with Canadians before AO can go out.

- Schedule needs NIRCам Phase A started in Feb 02

- Proposes a split between U.S. and Canada in NIRCам that is similar to the mid-infrared split

- One of his viewgraphs suggested that it may be "necessary to maximize the use of civil servant engineering labor to meet cost constraints."

- Goddard will offer costed work packages for instruments sections like IT&V, specific engineering design packages,

Use of these work packages will be optional -- when asked, he said that if a PI chose to have some of his work done via work packages, the PI would be responsible for the work's getting done but it was not clear whether the PI would be able to give direction to Goddard personnel.

The work package concept elicited a fair bit of discussion from the ISWG with most members viewing this as potentially a poor way of proceeding. It was also noted that one of the three SIRTf instruments was built at Goddard and cost the SIRTf Project more than either of the other two instruments in spite of the civil servant contribution.

CSA work elements will be defined in AO but will be generic and design independent
Mid-IR -- project has not accepted that Project Office be in the U.S. -- should be where ever I&T is done
Design concept for Mid-IR will use the MISC (Mid-Infrared Steering Committee whose existence was recommend by the earlier Mid-Infrared Planning Group) plan and not up for debate but MISC may not come into being soon enough
n need peer-reviewed science case for GTO time
n need technical design for U.S. contribution

MISC to complete allocation of top level MIR work elements during first meeting in late Feb.
MISC to develop instrument description and technical description of European and US work elements by 20 Mar.

Detector selection will be made after PIs are chosen -- won't be part of instrument selection

Simon Lilly stated that the Canadians want an intellectual stake in the design of the instrument that they participate in

Matt Greenhouse then presented a summary of the MEMS development status (see Greenhouse_mems_report.ppt).

The ISWG concluded the meeting in executive session. Debates in this session revolved around the Instrument AO issues, and how proposers could be offered a level playing field. The IWSG was also very unhappy that the Project could not do a better job of showing why the NIRCcam costs had to be split with the Canadians. The ISWG also was skeptical of including the guiding function in the NIRCcam. Attachment 4 summarizes the ISWG's recommendations on the Instrument AO. The ISWG also decided to send a letter to Anne Kinney expressing their concerns over various aspects of how NGST were proceeding. This letter appears as Attachment 7.

Attachment 1: Agenda for the 1st ISWG Meeting

Wednesday, January 24

STScI Boardroom

8:30 - 9:00	Coffee and pastries	
9:00 - 9:15	ISWG Welcome and Introductions	Rieke
9:15 - 9:30	Institute Welcome	Hauser
9:30 - 9:40	HQ NGST Perspective	Kinney
9:40 - 9:55	Procurement Regulations	Stevens
9:55 - 10:05	STScI & meeting logistics	Stockman
10:05 - 10:15	Break	
10:15 - 11:30	Science Program /Questions for ISWG	Mather
11:30 - 1:00	NGST Rescope	Seery
1:00 - 1:45	Lunch	
1:45 - 2:15	ESA Views and Concerns	Jakobsen
2:15 - 2:30	CSA Views and Concerns	Hutchings
2:30 - 3:15	How will we review the re-scope?	ISWG, Rieke to lead

3:15 - 3:30	Break	
3:30 - 3:45	ISIM Rescope Trades	Greenhouse
3:45 - 4:45	Rescoped Performance	
Stockman/Petro		
4:45 - 5:30	Discussion of what we have heard so far. ISWG/Executive Session	

Thursday, January 25 STSCI Boardroom

8:30 - 9:00	Coffee and pastries	
9:00 - 10:00	Instrument AO plans	
Greenhouse		
10:00 - 11:00	Science Policies for AO	
Stockman/Panagia		
11:00 - 11:15	Break	
11:15 - 11:45	Discussion of the Announcement of Opp.	All
11:45 - 12:15	Status of MEMS, other key technologies	Greenhouse
12:15 - 12:45	Discussion of planning for science review	Rieke, ISWG
12:45 - 1:30	Lunch	
1:30 - 2:15	Discussion of future presentations	Rieke, ISWG
	= What else would we like to know?	
2:15 - 3:15	Discussion of future work on science priorities, role of the DRM, role of science themes	Rieke
3:15 - 3:30	Break	
3:30 - 4:30	Draw up detailed assignments, wrap-up	

Attachment 2: Questions Posed to the ISWG by John Mather

- 1) How will the ISWG organize itself to answer all these questions, since a committee-of-the-whole takes a lot of time and is easily diverted from its target?
- 2) Does the Project re-scope reported to you significantly conflict with the recommendations made by the ASWG about priorities? Is there any reason for the Project not to proceed with the solicitation of the prime contract for the observatory?
- 3) Does the ISWG have any comments on the draft procurement documents for the prime contract distributed January 17? The source of any comments will not be released although we may release a listing of the comments received along with our disposition of these comments. We would appreciate receiving your comments by COB 30 January 2001 by email to Dan Blackwood (dblackwood@mail.hst.nasa.gov) with a cc: to Mary Stevens, NGST Contracting Officer, at Mary.V.Stevens.1@gsfc.nasa.gov.
- 4) Does the ISWG have any recommendations about the proposed method of acquiring the NGST instruments? We have many conflicting requirements to satisfy and need your advice about a reasonable balance. Do you agree with the proposed science policies associated with the instrument acquisition? What is your view of interdisciplinary scientists, and if you recommend them, when and how many?
- 5) Does the ISWG agree with the basic conclusions of the ASWG regarding the instrument complement? Have any new instrument technologies or concepts become available that might change that recommendation? Have new scientific discoveries changed our priorities? Does the prospect for ground-based adaptive optics on a 30 m telescope change your view? Jerry Nelson claims this telescope could have first light in 2009. Does the ISWG wish to revise the DRM?
- 6) Do you concur with the ASWG priority ranking of observatory parameters? The ASWG told us that ultimate sensitivity was the most important criterion, followed by wavelength range, resolution, and finally number of objects and field of view. We currently try to achieve a wavelength range from 0.6 to 27 μm , but without reaching ultimate performance at either end of the range.

- 7) How would the ISWG like to think about the tradeoffs about field of view versus pixel size? We (mostly Petro) have done studies about this but we have not changed any of our plans or baseline requirements. Much depends on how the ISWG thinks the instruments will be used.
- 8) Does the ISWG have any advice or ideas about separate guiders versus using the NIRCAM for guiding? We are trying to figure out what to say in our Prime procurement about this, so we are eager for suggestions and our time frame is short.
- 9) What briefings do you recommend for the Project to do to help the ISWG answer the questions asked, and how would you like them reported? Do you need any more materials provided?
- 10) Does anybody wish to sign a non-disclosure agreement to be allowed to see more of the information from the various contractors?

Attachment 3: Listing of Powerpoint Files from the Meeting

Greenhouse_ISIM_rescope.ppt
 Greenhouse_mems_report.ppt
 Stockman_Science_Policies.ppt
 ISWG_Petro.pdf

Attachment 4: ISWG Recommendations on the NGST Instrument AO

- 1) We strongly urge that the NIRCAM be solicited as a U.S.-only instrument and another route for Canadian participation be found. This is based on a combination of political and technical considerations. We also suggest making the baseline no guider in the camera and asking proposers to describe ramifications of including the guider in the camera.
- 2) We suggest that the AO not specify implementation details but rather give top level requirements such as power available, approximate volume, thermal dissipation, wavelength range, etc
- 3) Leave out Goddard work packages altogether.
- 4) AO must make collaborative nature of GTO programs on the mid-infrared instrument clear and that the US proposer is describing his vision of a joint science program.
- 5) Consider soliciting US Scientific representation on NIRSpec Team (or mention that this will happen).
- 6) Mention that Institute Instrument Scientists will be assisting instrument teams and working closely with them in the AO.
- 7) We suggest having the AO solicit a Telescope Scientist, a Facility Scientist, and 2 Interdisciplinary Scientists and leave open the possibility of adding more members later.
- 8) We strongly support including Guaranteed Time for instrument teams and SWG members and endorse the levels suggested by H. Stockman.

Attachment 5: Information Desired by ISWG from NGST Project

- 1) Understanding of how image degrades with λ and what are the cost impacts of improving the $\lambda < 1\mu\text{m}$ image quality.
- 2) Sensitivity at 5-27 μm as a function of constant sunshade + variable OTA heating (30...K to 60...K)
- 3) Assumptions used in determining the affordable number of pixels.
- 4) Assumptions about the degree of instrument complexity -- number of operating modes and so on.

Attachment 6: Draft Charge to the ISWG for the NGST Re-Scope Science Review

The ISWG shall consider the revised design for the Next Generation Space Telescope in the same spirit as the first NGST Science review, the NGST External Science review conducted in December, 1998, by the NGST SOC under the chair of Rob Kennicutt. Discussion of NGST and its science goals with your colleagues before the formal review is encouraged. The ISWG will prepare a final report for NASA HQ on the review by April NN,2001, which will be signed by the chair of the ISWG with the concurrence of the U.S, European and Canadian Project Scientists. Specifically, the committee shall determine

- 1) the scientific capabilities of the revised NGST in comparison to the baseline 8-meter NGST, and in comparison to what other capabilities will be available to astronomers in ~2009. What science, if any, has been completely lost? Are the scientific capabilities still consistent with the Decadal Review Ranking?
- 2) which science goals should serve as the benchmarks for mission success and which should be used as guides during the design of the mission;
- 3) which design parameters (e.g., telescope diameter, image quality, wavelength coverage, pointing and other operational constraints, telescope temperature, etc) are likely to have the strongest impacts on the science return of NGST;
- 4) to what extent the Design Reference Mission needs revision in light of the rescope.

The ISWG may also consider other aspects of the project as they chose.

Attachment 7: Letter to Anne Kinney resulting from this meeting

February 6, 2001

Dr. Anne Kinney
Origins Director
NASA HQ
Washington, D.C.

Dear Anne,

The NGST Interim Science Working Group met at the Space Telescope Science Institute on January 24 and 25. We heard presentations on the re-design of the NGST telescope and on plans for an Announcement of Opportunity for construction of instruments for NGST. Our preliminary assessment of changing the primary mirror size from 8-meters to 6.5-meters indicates that there of course will be a degradation in the ultimate sensitivity achievable but that much of the science program that makes NGST exciting is likely to be still feasible. We will report more fully in March. However, our

assessment of the Announcement of Opportunity and of plans for the instrument package reveal a number of issues that require resolution before we can support release of the AO. We agree that getting the AO out as quickly as possible is an important goal, but we want to be sure that the AO is soliciting the correct capabilities.

First, the ISWG was informed that the Near-Infrared Camera which had been presumed to be an instrument to be built in the U.S. would have to be split among the NGST partners (between the U.S. and Canada) because of a lack of resources. We asked to be shown the details of what was driving this lack, but were told that because we were potential proposers, we could not be told anything further. We understand the sensitivity of procurement issues, but without understanding the drivers for this split, we cannot concur or give advice. Splitting the NIRCcam would have several negative consequences. If it were split, then no instrument on NGST would be built solely by the major partner in the mission. Furthermore, all three instruments would involve split responsibilities (NIRSpec with U.S. providing detectors and the MEMS and ESA providing the remainder, MIR Instrument with the U.S. providing detectors and ESA the optical bench with some components TBD, and the NIRCcam with the U.S. providing detectors and the remainder subject to a TBD split between the U.S. and CSA). This arrangement requires more complex interfaces which in turn means a larger fraction of the instrument budget being spent on developing interfaces and controlling them. Given the cost constrained nature of NGST, we would like to explore how splitting the NIRCcam could be avoided so that a larger fraction of funding goes into scientific functionality and less goes into interfaces. We also understand that any solution will require defining appropriate scientific and hardware roles for our Canadian partners some where in the ISIM. We also note that having no U.S.-only instrument on NGST is likely to have a negative political impact in the U.S., and would significantly reduce NGST's value as a training ground for future instrumentalists.

Second, we discussed the project's plans for including a guider as part of the NIRCcam in the AO. We are worried that the AO will over specify the NIRCcam and will not yield the best possible instrument. We are also concerned that forcing NIRCcam to include the guider functionality as the Project Office has envisioned it in the past will not give proposers adequate design freedom, and that we may not get an optimal solution for the scientific imaging needs and the required guider/wavefront sensing needs. The Project has indicated that they would be interested in finding a better way to solicit the guiding function, and we think this is essential before releasing the AO.

Last, we are concerned that the Project is making technical decisions that affect the partners in NGST and its scientific capabilities unilaterally. For example, because of a lack

of funding right now, the Project decided that cryocoolers are not viable because they could not be developed in time. In conjunction with this decision, the Project also asked ESA to take responsibility for the cryostat that would be needed in place of the cryocoolers required for the mid-infrared instrument. Such decisions need to be made in a broader forum with more parties involved. Key decisions that influence the scientific capability of NGST need to be made in concert with the ultimate scientific users of NGST as represented by the ISWG and the project scientists from all the partners.

We ask you and the NGST Project Office to work towards better communication between the NGST partners and between the Project Office and the scientific community. To address the issues raised above, we request another meeting of the ISWG before the AO can be considered final, and we propose meeting on March 12 and 13. We will request specific information that we believe is needed to enable us to make a final recommendation on the AO far enough in advance that possible procurement issues involving ISWG members can be settled before the meeting.

The ISWG believes that NGST can be the mission that garnered the top recommendation in the Decadal Survey, and we are eager to ensure that NGST will be capable of achieving the scientific goals that have been set for it.

Sincerely,

Marcia Rieke
ISWG Chair

cc: R. Howard, H. Hasan, J. Mather, H. Stockman, P. Jakobsen, J. Hutchings